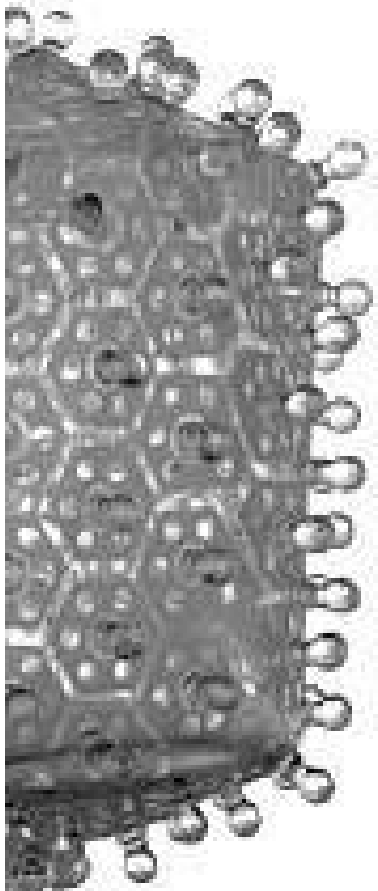

Microbiology

Lecture No: 35

Dr Name: Dr. Hassan

Done by: Amani Al-Halabi

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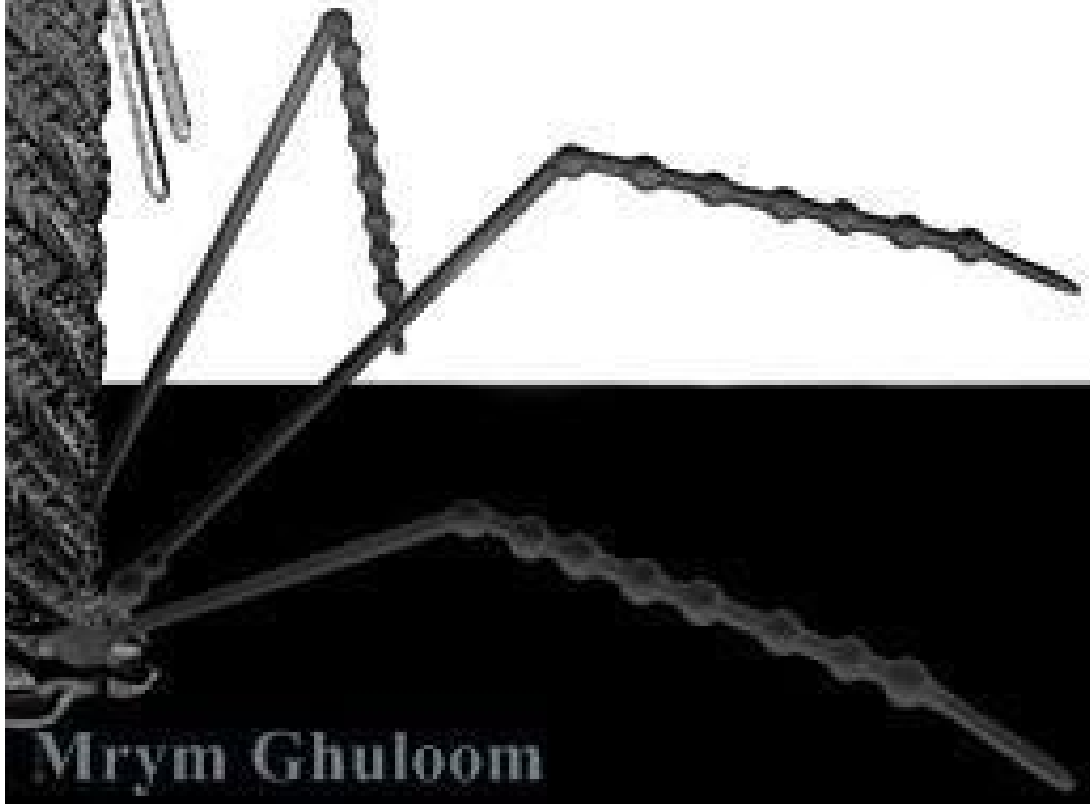

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TREMATODES –FLUKES-

Some Notes:

1- Trematodes in general (with one exception only which is Schistosoma) are hermaphrodites, same as cestodes.

* What does "hermaphrodites" mean? It means that one worm has both male and female reproductive organs, (has its own male and female gametes).

-Schistosoma is the **exception** here with its:

Separate sexes, different size, different morphology and different eggs.

2- Regarding the **size**; it's about 7-8 cm in length.

3- **Life span**: can reach up to 15-16 years, they last for a long time usually.

4- They all need an **intermediate host**. –No exceptions-

The intermediate host is always a member of the mollusks family (fresh water snails, برّاقة مائيّة).

5- **Morphology**; the worms are oval & flattened in shape. The tegument or the surface is covered with small spines that help in anchoring the organism to the wall of the lumen in which it's located.

- Two other structures that contribute to anchorage; **2 Suckers:** one is "ORAL" (around the oral opening), and the other is "Ventral" (situated to the ventral aspect of the worm).

Written by Amani Al Halabi

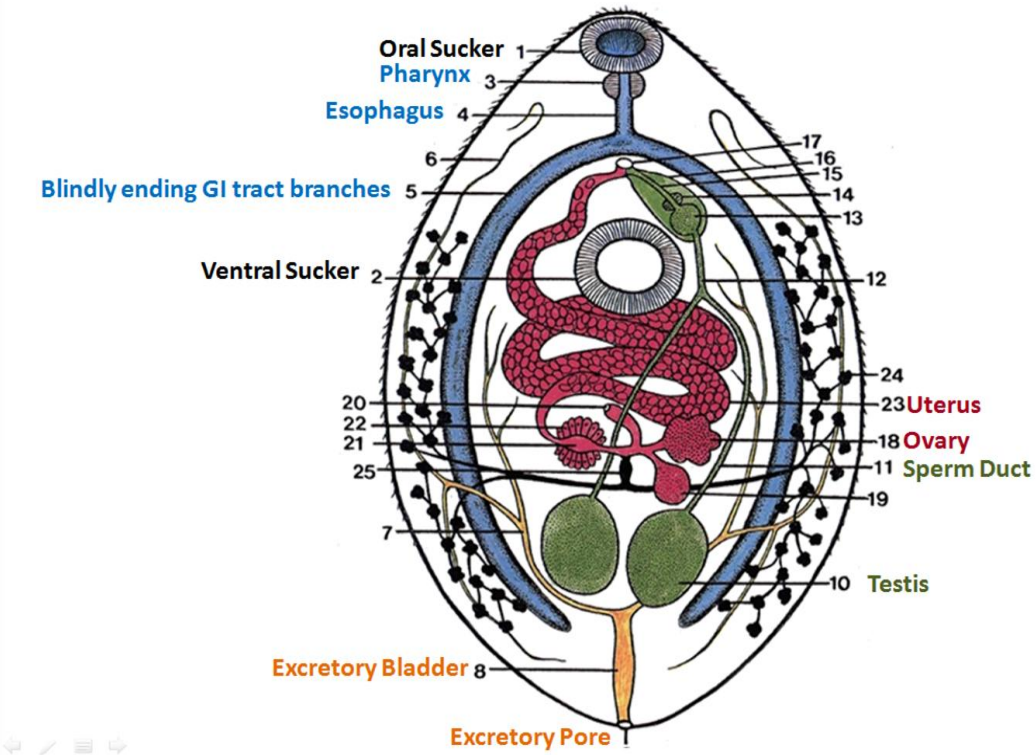
6- These worms have a **GIT**, (unlike Cestodes which don't have it), but this GIT is not really complete.
It begins with the mouth and the oral sucker, pharynx, esophagus, then the tract divides into two branches, these branches extend to the end of the worm BUT they end **blindly** (they don't end in an anal opening) and that's why we're saying that it's not complete.
Note that: any undigested material is regurgitated (comes out through the oral opening).

7- They have a **nervous system**.
Trematodes have ganglia and nerve fibers that extend forwards, backwards, and laterally.

8- They have an **excretory system;** collects waste materials, in certain tubules, and excretes them through the excretory pores at the posterior side of the worm.

9- A **Reproductive system**: these worms have female reproductive organs and male reproductive organs, (Remember: they are hermaphrodites!)

- Notice the testes, the openings of ducts, the ovaries, and the uterus.



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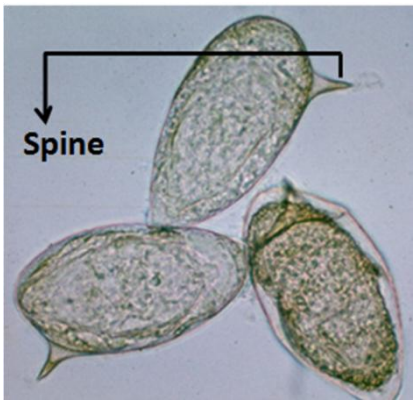
Note → fertilization occurs through either self-fertilization (Fusion of male and female gametes produced by the same individual), or through cross-fertilization (if more than one worm is present).

10- The **eggs** are really distinctive; they're very **large** considerably, and usually contain a lid which is known as **operculum**. So we say: the eggs are operculated.

→ The exception here is Schistosoma again!

-Their eggs don't have opercula, they have spines instead.

-Their shapes are different; females look more rounded rather than flattened worms, while male worms are flattened and more elongated.



* the eggs go out of the body from certain places depending on the location of the worm inside the body and where it's situated.

For example; if the worm is in the GI tract of a patient, the eggs go out with feces. If worms are located in the lungs, their eggs are going to go out with sputum. If worms are located in the bladder; their eggs will go out with urine.

* Wherever they are, these eggs need to go back to water since the intermediate host as we mentioned before is the freshwater snail.

* When the eggs reach the water; the operculum opens up and releases the embryo or the "**Miracidium**", this small Miracidium is ciliated so it can swim, also the anterior end of this Miracidium has a hook or a spine that helps in penetrating the mollusk.

→ Again briefly: eggs reach the water, the lid opens, release of the Miracidium, it swims and heads to the inside of the snail.

* Inside the snails' tissues, it goes through a cycle of multiplication, through which it divides and produces a "**Sporocyst**"

- Sporocyst: a round structure, full of cells.
Inside this sporocyst you'll notice some sort of development of internal structures, one inside the other, to form what's called: "**Redia"**.

Redia → looks like a primitive worm (it's going to be a worm), so it has an opening with a sucker and it eventually develops into a "Cercaria"!

Cercaria: looks like an adult worm; it has a GIT with oral and ventral suckers. Additionally, it has a tail that helps in going to and swimming in water. (A primitive, immature worm)! This Cercaria leaves the snail and goes back to water looking for a new host.

→ Cercaria enters the body of the new host by one of two ways;

1- Some of them (mainly the **Schistosoma**) tend to **penetrate the skin** of the new host and go inside, these ones maintain their tails and use them in swimming until they find the new host whom they will live and become mature adult worms in.

2- The other way that the **majority** of the worms use is **going to the GIT by ingestion** (they are eaten by the new host).

- This type swims in the water until it finds a creature in the water, for example a fish, a crab, or even plants.

- When it reaches that creature, it loses its tail, covers itself with a protective wall, and becomes enclosed as a **cyst**!
This cyst stage is known as "**Metacercaria**".

→ Metacercaria is going to be eaten by someone who is eating some contaminated aquatic plants or improperly cooked sea foods. By that, the Metacercaria reaches the GI tract and becomes an adult worm.

The life cycle is complete when the worm reaches the adult stage! (:

Let's summarize the main events of life of a Schistosoma worm:

Some people urinate or defecate in the water (the eggs are released either with urine or feces) → the eggs release miracidium and that in turn enters a fresh water snail and develops inside it into Redia then Cercaria → the Cercaria goes back to water and finds a person that is using that water for playing or washing → it infects them by entering through their skin, then it travels through blood, it reaches the UT or the GIT, settles there and completes its life cycle and starts producing new eggs, (their eggs don't have opercula they have spines).

Other Trematodes which develop Metacercaria:

Eggs pass with the feces -for example- to water → operculum opens up → releasing the Miracidium → Miracidium enters a snail → forms redia → comes out of it to water as Cercaria → Cercaria enters a sea creature and become Metacercaria insisted on the surface of that creature → creature gets eaten by a new host → worm reaches the GI tract becomes an adult and starts producing new eggs!

* By that we've just covered the whole overview on parasites.*

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Pathology:

Diseases associated with the infection of parasites:

- Actually you don't have that significant pathologic effect; they usually live for many years without causing problems to the infected person.

- Sometimes they cause problems; could be mechanical problems or some kind of irritation.

Example1: hookworms located in the GIT, have teeth that enable them to adhere to the walls of the GIT and suck blood, producing bleeding that lasts for some time and could cause iron deficiency anemia.
Example2: Ascaris may block the common bile duct causing cholangitis, or it may block the appendix causing appendicitis. (These are mechanical diseases)

- In some cases, the body may develop an inflammatory process or an allergic reaction which results in a damage of tissues.

→ We deal with each warm and its pathogenicity separately!

A Question: if a blockage of the bile duct occurs, do we end up with hypercholesterolemia?

Actually it causes what's worse than a hypercholesterolemia case!
It mainly tends to elevate the level of bilirubin, causing jaundice (الصفار), or certain inflammations like cholangitis and pancreatitis which are more severe and dangerous than elevating the cholesterol level in blood.

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Diagnosis:

- Sometimes the patient may visit the doctor, holding in hands a worm from his feces, but to see the worm itself isn't very common.
- In cases of Protozoa you can look for the presence of cysts in the stool, like in cases of amoeba, balantidium, and giardia.
- In cases of worms you look for eggs in the stool, in urine, or in sputum (by microscopic examination).
- In some cases (e.g: Malaria, Microfilariae) you need to examine the blood by using a blood smear.
- In cases of Trichinella worms, you need to do a biopsy of muscles, and you will find the larvae in the muscles.
- In cases of Leishmania which usually produce ulcers, you will take a biopsy of the ulcer and examine it under the microscope to check the presence of amastigotes.
- Sometimes (as in Trypanosomiasis) (مرض النوم), you examine the cerebrospinal fluid –CSF-.

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Indications:

EOSINOPHILIA is commonly seen withparasitic infections (an increase in the number of eosinophils in the blood, can reach up to 40%).

- Another indication of the parasitic infection is the development of an ALLERGIC REACTION, which also causes a condition of Eosinophilia.

White Blood Cells are composed of:

Eosinophiles: 3%	
Basophiles: 1% or less	Monocytes: 7%
Lymphocytes: 30%	neutrophils: 60%

- IgE level -an immunoglobulin (antibody) - will be elevated in the serum if the patient is suffering from a parasitic infection in general. While in normal people IgE is found in very low concentrations.

→ Sometimes, IgG levels would be elevated as well, and this can be used in diagnosis of specific parasitic diseases.

* Eosinophilia & high concentration of IgE are usually associated with parasitic infections within tissues (tissue parasites), while in conditions of luminal parasitic infection you may not get Eosinophilia nor IgE elevated levels, but may develop some specific IgGs!

→ (In general, the response of the body towards a luminal parasitic infection won't be intense as if it's inside the tissues.)

* IgE has a role to do in allergic reactions, but its main function is to act in cases of parasitic infections.
- What does IgE do? it attaches to mast cells making them release HISTAMINE. Histamine works in allergic reactions, inflammations, increasing vascular permeability, produces smooth muscle contraction, and all of this will affect the movement and the secretions of the GIT leading to → excretion of the parasitic agents to the outside.

- There are no specific enzymes to kill the worms.
→ A Drug: Piperazine → used in infections of ASCARIS, it paralyzes Ascaris (doesn't kill it), so the Ascaris worm won't be able to stay in the lumen, and it's finally excreted (alive) outside the GIT.

* Eosinophils secrete basic proteins that kill the parasites at the site of inflammation.

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Treatment:

There are many available drugs for all parasitic diseases, but some of them tend to be a little bit toxic.

- Pharmacologists will teach you about it later on.

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Prevention:

- Prevention is very important in parasitic diseases.
- The first preventive action is to keep the hygiene at a good level for it really prevents many parasitic diseases.

For example: if you don't defecate in soil, or urinate in water, and you're using toilets all the time, then all the exerted parasites (eggs and cysts) will be eliminated and killed and won't transfer to another person. This is very important especially if the life cycle involves an intermediate host, like the cell cycle of Schistosoma, the snails which are intermediate hosts won't get the eggs and the cell cycle is interrupted in this case.

→ You can destroy all the intermediate hosts (for example: killing all snails) but it's very difficult.

Another example on this is when you try to kill all mosquitoes by spraying insecticides.

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Vaccination:

There are no effective vaccines available against parasitic diseases.

We have anti-bacterial vaccines, anti-viral vaccines, but not anti-parasitic vaccines!

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THE END

لا نهاية أفضل من الدعاء بالتوفيق والنجاح، البركة بالوقت والفهم، وطلب العلم النّافع والأيام الجميلة وسنوات العطاء إن شاء الله (: